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DECORATIVE FABRICS AND NEW FINISHES AND WHAT CAN BE EXPECTED OF THEM*

by
Dr. Jules Labarthe, Jr.
Senior Fellow
Mellon Institute
Pittsburgh, Penna.

When I was invited to speak before this conference for State Home Furnishings Specialists, I accepted with great pleasure but with no little trepidation. After all, it does require a certain amount of courage for a man to speak before any group composed entirely of women, even when they are not designated as and known to be specialists in the field. The first really encouraging thing about my role in this conference was when several weeks ago Miss Dorothy Iwig visited our laboratory at Mellon Institute, and left there a list of questions which she hoped I would answer during the course of this brief discussion on the new materials for use in home decoration. Unfortunately some of the problems which she stated were not yet solved by you specialists, have not yet been solved by anyone to the best of my knowledge and all we can do is to discuss them and to try to conjecture as to where some of the solutions may lie.

To begin with, our producers of the new textile fibers are gradually accumulating a vast store of information about these new products; these synthesized textile filaments, but much of the information that is available deals only with their filament or fiber state and the part played by some of these physical and chemical properties when the same materials are brought to us as fabrics either composed entirely of the new synthesized fiber or of that material blended with one of our traditional fibers is still quite obscure. Another complicating fact is that the greatest amount of technical investigation of these new materials has been in their application to wearing apparel and, therefore, from the standpoint of home furnishings views we must fall back upon some of the basic chemical and physical knowledge that has been accumulated and to try to apply these data to home furnishings service conditions. This is not always easy to do because as you well recognize the fabric construction, to say nothing of the addition of special finishes, greatly alters the fiber characteristics in such things as curtains, draperies, upholstery materials, and even in rugs or carpets.

The reasonable way to approach this very intriguing subject would be, I think, to discuss in brief some of the properties in our new synthesized fibers have in common. Also, some of their points of difference by way of exploring their significant place in our home decoration scheme. We should not neglect the natural fibers and certainly not the other important man-made fibers such as rayon, acetate, and fiberglas. In this regard, the role played by special chemical finishes would be of very significant importance in evaluating the service-life that consumers have a right to expect of household fabrics made from all of these materials. With Dr. Dorothy Lyle appearing as the other speaker in the program this morning, it is perfectly understandable why I should stay away from the question of cleansing and caring for these materials as far as I possibly can because in that field there is no one as expert as she is.

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Let us look at these new synthesized fibers for some common properties before we investigate the individual peculiarities of the members of these new groups of textiles.

1. Lightness in weight - As a class, the synthesized fibers are somewhat lighter in weight than those occurring naturally.

2. Low moisture absorption - These fibers absorb far less water than any of the natural fibers or rayon or acetate. Most of them absorb only 3 to 10% of their weight of water even after prolonged soaking.

3. Ease of washing - These fibers and the fabrics made from them are generally easily washed because dirt has not been carried into the fibers by moisture in the atmosphere or by casual wetting with water. Thus, the cleansing of these fabrics is more a matter of washing off the attached dirt than having to pull it out of the fibers.

4. Rapid drying - Having absorbed little water in the washing operation, it is natural for us to regard speedy drying of these synthetics as a further advantage. The peculiarities of some weaves, however, counteract this rapid drying tendency.

5. Static electrical effects - An undesirable feature of all these fibers is the production of static electric sparks when rubbed, especially with a protein substance. We will go into this phenomenon a little later when we discuss some of these household fabrics applications.

6. Permanence of shape - Fabrics made from these fibers are generally outstandingly good in their permanence of shape; that is, their ability to resist shrinking and stretching during washing and cleaning. However, individual fabric weaves and the strains and stresses imposed upon the fabric during weaving or processing sometimes introduces a relaxation shrinkage factor which is not always recognized by the user. In this connection, we might also include the relative permanence of pleats and creases that may be formed in such materials as drapery fabrics particularly the headings.

7. Thermoplasticity - This term refers to the heat softening of a plastic, and all these synthetic fibers--that is, nylon, orlon, dacron, dynel, acrilan--are really thermoplastic resins. They are, therefore, damaged by excessive heat in ironing and a cool iron should be used for them just as on acetate, although there is a distinct difference in the softening points of the various members of this group.

8. Dyeing - Low moisture absorbency has made it necessary for the textile chemist to improvise new methods of applying the art of dyeing, and unconventional methods have been required to get color into such fibers as orlon and dacron, in particular.

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9. Insect resistance - None of our common household insect pests consume these man-made fibers. It is possible, however, for insects such as clothes moths larvae to chew their way through a synthetic fabric in order to escape from some inner layer such as wool batting or feather filling with which a comfort may have been filled.

10. Mildew resistance - Mildew will not affect any of these synthesized fibers. This makes it possible for their use in many hot, humid areas where the natural fibers are readily and rapidly destroyed by micro-organisms such as bacteria, mildew, etc.

Summing up these 10 common properties as far as the synthesized fibers are concerned, I would put in the plus column such things as lightness in weight, low moisture absorption, ease of washing, rapid drying, permanence of shape, insect resistance, and mildew resistance. In the negative column, we must put in the static electrical effects, the thermoplasticity or heat softening, and the problem of dyeing.

The significance of these disadvantages or minus ratings should be apparent to any one interested in home decoration. The static electrical effect, unless it is neutralized with one of the new anti-static finishes or perhaps even by the use of anti-static rinses, can at times make these fabrics extremely susceptible to rapid soiling from household dust. For example, when nylon curtains first came on the market, it was not at all unusual for some of the nylon curtains even in a store display to become somewhat dingy and gray from dust after hanging for a very short period of time. This was due to the fact that the dust, having a positive charge, was attracted by the nylon curtain fabric which had a very slight negative electrical charge. Thus dust stirred up in the room was attracted to the nylon curtains just as iron filings go to a magnet. Very quickly manufacturers found that the problem could be solved by the use of a permanent finish on nylon, and today's nylon curtains do not give us this particular disadvantage. Similarly, we would have had the same trouble with orlon had the problem not been solved for nylon. This problem of dust catching is rather common in many households, too, where they have plastic articles in the form of upholstered furniture or plastic wall tile and seemingly the more often these are washed off by the housewife the more rapidly they seem to accumulate dust. If the housewife were to use one of the new anti-static rinses or even a few drops of vinegar in her rinse water, she would to a certain extent nullify this dust-catching ability and her wall tile and her plastic furniture seats would stay fresh and clean for a longer period of time.

Thermoplasticity or heat softening is, in my estimation, one of the principal disadvantages faced by all of these synthesized fibers when it comes to applying them to upholstered furniture, to rugs and carpets, and similar applications where there is danger of having a lighted match or live ashes from a cigarette fall on the material. The danger is not from fire but from melting holes in the synthesized fiber or fabric surface. A melted hole of this kind in a piece of upholstery fabric of nylon, orlon, or dacron would be an extremely difficult type of damage to correct or to conceal. Furthermore, I am not entirely sure that damage of this type would be covered by all fire insurance policies because there would be no live flame produced. The damage to an all-nylon rug would be very serious, too, because all of the pile fibers would be melted down to mat.

The problem of dyeing is principally one of costs to the producer. However, even today in all of these new fibers, we do not have a wide range of colors as we have been able to achieve in the natural fibers or in rayon and acetate. Then, too, all of the colors produced have not yet been thoroughly evaluated as far as light exposure is concerned or perhaps even to frequent washings and cleanings that a drapery material might have to withstand.

At this point, it might be well to consider the individual fibers and some of their own peculiar properties as are reflected in fabrics made from these synthesized materials.

Not all these synthesized fibers have yet been applied very generally to consumer use-experience in household or decorative fabrics. However, I shall try to conjecture as to the role several of these may be expected to play based upon their own individual properties as well as the properties they have in common with others as already listed. In this rather unofficial forecast, I would like to approach the fibers in the order of their seniority; nylon, orlon, dacron of duPont; dynel from Carbide and Carbon Chemical Corporation; Acrilan from the Chemstrand Corporation; and then deal with miscellaneous fibers that are not quite within this category but which are man-made; namely, fiberglas, acetate, and rayon.

I shall try to present the story of each fiber in much the same pattern as far as the end-use item is concerned. Thus, I will treat with curtains, draperies, upholstery applications, and rugs or carpets in that order.

The senior member of this group of fibers is nylon. Unfortunately we do not have any common generic term yet that we can apply to these kinds of textile materials. I certainly do not like the word "miracle" fibers, and there seems to be a suspicion that the term "synthetic" carries with it an implication of inferiority. For that reason, I have preferred--in this paper at least--to refer to them as the synthesized fibers. I suppose that broadly speaking, just as in the case of the term "man-made," the word "synthesized" could include fiberglas, acetate, and rayon, but I am trying to restrict it to those fibers which have been synthesized from simply chemical compounds by processes of polymerization.

Nylon is outstanding among our materials for tensile strength, for abrasion or rub resistance, it is generally regarded as being non-flammable, and possess fairly good crease retention properties. Some of its peculiar disadvantages are deterioration from ultraviolet light, low resistance from contact with acids including industrial gases in the air, indifferent draping qualities in heavy drapery materials, lack of softness of hand, and only moderate resistance to wrinkling.

Looking at these properties in terms of the end-use applications, we see that nylon makes an excellent curtain material for its high transparency, good strength, ease of washing, drying and handling with little or no ironing (especially when the nylon curtains are folded when washed so as to avoid heat setting wrinkles into them during the normal washing operation), and we need not fear the effects of mildew, insects, and some of the other fabric destroying agencies in use. Despite all these advantages, nylon curtains in areas where the sun exposure is great are not ideal. Like all the textile materials we have had prior to the advent of nylon, this fiber is sun-rotted and rapidly loses strength in a sunny window. To a considerable degree this can be avoided by having the curtains rotated around the house so that the same pair of curtains is not always in the most sunny exposure. Nevertheless, some of our newer materials both in the synthesized fiber field and in fiberglas offer us a vastly better source of satisfactory consumer use-experience than does nylon.

In draperies, nylon has not been a too important fiber thus far, and I think in this regard that it is something that has been pretty much overlooked by producers. Nylon could add greatly to the durability of other textile fibers used in some of our typical drapery fabric constructions whether the other fiber were wool, cotton, rayon, acetate, or other of the synthesized fibers such as orlon, dacron, dynel, etc. We know from many use tests that nylon in quantities up to 15 or 25% will greatly increase the durability of fabrics and should not have too great an effect on the handle or draping qualities. The dyeing problem is an important one, of course, and possibly this is one of the stumbling blocks that the mills have had to recognize.

There are two potential uses for nylon in covering of furniture: one, as a blend with wool or with wool and mohair or wool and rayon or perhaps even with cotton as an upholstery fabric for overstuffed furniture; the other application is the use of nylon multifilament in woven form as a covering material for dining room chairs, kitchen chairs, porch furniture, and similar applications in which the filling is more firm and much less thick than in the ordinary living room furniture. In this regard, I think we should recognize the perils of cigarette ashes and matches dropped on such materials. For this reason, I think that nylon blended with wool or mohair or some fiber capable of quenching the flame from a cigarette ash is a "must." Melted holes are more serious as far as repair is concerned than those

that are burned or charred through; nevertheless, we do have much positive evidence to show that nylon adds greatly to the durability of some of our traditional wool and wool-mohair fiber blend fabrics such as freizes and upholstery velvets.

In rugs and carpets, nylon is "out-of-this-world" both in durability and in price. We don't know too much yet about the ideal quantity of nylon to have blended in with wool or with rayon or combinations of the two in rugs and carpets for various room and traffic exposures. There can be no arguing the fact that nylon adds greatly to the durability in such blends; nevertheless, the concentration of nylon should not be too high because of the thermoplastic nature of the fiber.

ORLON

Orlon is the second member of the duPont trio, and in many respects it owes its greatest potential serviceability in the very fields where nylon is most weak; notably, exposure to light and exposure to acid fumes. Orlon curtains are not quite as transparent as nylon due to the fact that the filaments do not pack as tightly in a yarn as do the perfectly round nylon fibers. This is generally referred to as a low bulk density peculiar to orlon and to a somewhat similar degree to Dacron, both of which fibers are irregular in cross section. Like nylon, orlon curtains can be washed easily and quickly with very rapid drying and with little or no ironing required. They are very stable dimensionally, although we have encountered a few cases of customer complaints about the shrinkage of orlon curtains particularly over a radiator. We believe that this is primarily a matter of relaxation as contributed by strains during the construction of the curtain rather than an intrinsic feature of the orlon fiber or yarn. As we view orlon in curtains, the principal problem is the flammability which has not yet been cured in the continuous filament yarns. Orlon staple fibers can be given a flame resistant finish which makes this fabric no more hazardous than most other fibers when constructed in yarns and fabrics of the same type. Our advice that we have been giving to Kaufmann customers is that if they have in their household small children who do not have proper regard yet for lighted matches they would do well to buy something else than orlon. Except for this one disadvantage, I consider orlon to be one of the finest of all available curtain materials, and certainly in a community where the exposure is both from sunlight and from industrial gases orlon is vastly superior to anything we have ever had in the past.

DRAPERIES

We have found orlon only to a very limited extent in drapery fabrics, even as a blending fiber, but in this field of application I think it has extremely fine potential advantages. As in the case of nylon, however, the dyeing of the fiber is a problem and evenness of color in the orlon constituent filaments and the others would be difficult to achieve.

In upholstery materials, I regard orlon as being of great potential serviceability particularly in staple yarns. Spun or woven with wool and mohair or with rayon, these fibers could be made satisfactorily fire retardent to give perfect safety but that would not take care of the heat softening or melting properties of orlon, and it faces the same problem as with nylon in this use application. I would not expect orlon to be a particularly important fiber in rugs and carpets except perhaps some of the novelty throw rugs of the shag type. Here, orlon is a natural because of its ease of washing and its permanance of nap retention and its rather good resistance to napping or crushing down. Such rugs would be virtually non-absorptive as far as moisture is concerned, and here I think we should recognize one other peculiar feature of orlon--that is the wicking of moisture through it. In the case of orlon and also of dacron, the surface tension of water in contact with these fibers is very low. This means in lay terms that the friction between the water layer and the fabric or fiber is extremely low and water can pass along the outside of the filaments with ease. If, therefore, water were spilled on a rug of orlon, it would pass rapidly through the fabric and wet the surface underneath, not by absorption of the moisture by the orlon but by this wicking action. It is the same effect we have noted with orlon suits that rain soaks through them rapidly, and in orlon shirts that perspiration passes through the fabric and evaporates away thus making orlon shirts much more comfortable to wear in hot, humid weather than the equally non-absorptive nylon shirts of several years ago. I would expect, therefore, that water-carried stains would go through orlon upholstery or orlon rugs with extreme ease.

DACRON

Dacron is the last and, in many respects, one of the most interesting of the duPont trio. In continuous filament, it is very like silk or like nylon and orlon; whereas in staple filament spun into yarns, it is more wool-like than any of the synthesized fibers thus far mentioned. Only recently Dacron curtains have appeared on the market. This fiber is probably of not quite as great sun resistant as Orlon, it is reasonable to expect that they will be equally washable, and will have somewhat greater resistance to flammability. Dacron is closer to nylon in wear resistance than any of the other synthesized fibers and has unusual ability to retain crease and fold structures that are sealed into it. The softness of hand, too, is superior to that of nylon but comparable to orlon. We would expect, therefore, that dacron would be an admirable material for use alone or in combination with other fibers in drapery fabrics.

Except for the thermoplastic feature of this and other fibers, we would expect it to be a good material for upholstery fabrics; however, it does seem to be more electrostatic than some of its fellow fibers and possibly would hold lint more readily than many of the others in this type of end-use application. Surely it would benefit by sponging with a treatment for making it less electrostatic

in nature. Dacron is still in fairly short supply; the whole production of dacron was only started in the fall of 1952 and thus far the larger proportion of the fabric has been made available to wearing apparel. However, it is a material that all homemakers should look forward to using because of its many unusual physical and chemical properties as shown on the series of tables I have distributed to you here today.

DYNEL

Dynel differs greatly from any of the fibers hitherto described since it is a copolymer of vinyl chloride and acrylonitrile. Thus far it has been available only in staple form; at least that is the only form in which I have seen it and as a staple it is extremely wool-like in feel, hand, and in texture as well as appearance. Thus Dynel is not yet at least of importance as a curtain material; however, in draperies, alone or blended with wool, it affords an excellent drapery with good hang and pleasing folds. Furthermore, the presence of Dynel adds to the fire resistance of the fabric if it should be combined with one that is more flammable because Dynel will not burn. It is more thermoplastic; that is, it melts at a lower temperature than any of the fibers thus far mentioned so its pressing is a serious problem and the danger of damage from cigarettes should not be under estimated for it softens at 275° F. This extremely low softening temperature makes it unlikely that Dynel will be of too great importance in upholstery materials or in carpets. Furthermore, in carpets the dyeing of the fiber is a real problem. One of the principal uses to which Dynel has been put is in blankets, and in this regard it is superior to any of our synthesized fibers; at least those that have appeared on the market as yet.

It is reasonable to suppose that Acrilan will differ not very greatly from Orlon in many of its physical and chemical properties, and the as yet unnamed Fiber X-51 from American Cyanamid probably will be Orlon-like too since it is a copolymer of acrylonitrile with methyl methacrolate.. Saran is just beginning to get into the multifilament yarn field. We have read about highly successful Saran multifilament carpets and rugs, but we have not yet seen any of these in actual use. Saran came on the market originally through the Dow Chemical Company as a monofilament and as such achieved its instant success in automobile seat covers and as a woven cover for rather hard surfaced or firmly cushioned chairs; for example, garden and porch furniture use Saran monofilament coverings to very good advantage. It is also applicable to porch rugs as is nylon monofilament. These monofilaments can make very attractive drapery hangings, particularly in informal rooms, play rooms, on porches, etc.

Recognition must be given to Fiberglas as an important household fabric. In many respects, this is the most satisfactory of our glass curtain materials. It is less transparent than nylon or even than Orlon. The color is an integral part of the fiberglas

filament and, of course, we have a material that is absolutely nonflammable. Fiberglas curtains, draperies, and other household fabrics are washable, but they should be washed alone and preferably with not more than one or possibly two pieces in the wash load if a tumbler-type washer is used. They are easily washed by hand, and it is only a matter of getting the dirt off the surface as in the case of our synthesized fibers. The point is that fiberglas has very low mechanical wet strength and is very susceptible to abrasive damage and complete deterioration when rubbed, twisted, or otherwise mistreated while wet. Fiberglas curtains are customarily washed by hand or in a tumbler-type washer then gently squeezed and hung to dry. No ironing, of course, is necessary. We have had a few cases of customer complaints about the graying of fiberglas and possibly in these specific instances it has been due to the oxidation of the oil and perhaps the sizing oil has taken up dirt and is very resistant to the extraction of the dirt by the washing operation. We have had relatively little success in clearing and freshening such curtains. Fiberglas, now that we have the Coronize treatment, has a hanging and draping quality fully equal to that of the finest silk and, as a matter of fact, I consider it much more pleasing and graceful in its folds than our synthetic or synthesized fibers.

Mention should be made of rayon and acetate; however, it might be best to bring out some of the new developments in these fields in questions after my paper. I do not wish to neglect acetate, however, because of an outstanding development of recent months in this fiber. I am referring, of course, to the development of the dope-dyed acetates. One of the most common complaints about acetate in draperies and in other household fabrics in the past has been the gas or fume fading of these materials over a prolonged period of time, and if the blue component dye was moderately resistant to gas fading, the resultant color seemed to be susceptible to sun fading. In this dope-dyed process, it is possible to get the dyestuff into the material in "dope" or solution form so that when the filament is extruded and spun the dyestuff is an integral part of the fiber itself. The Tennessee Eastman Company came out several months ago with Chromspun acetate which they guarantee to be color fast for the life of the fabric. The Celanese Company has a similar fiber called Celaperm. We have had samples of both these in our own Fellowship laboratory at Mellon Institute, and have found them to have astonishing fastness to washing, gas fading, to light, and to most other color-destroying agencies. One complication is that it is impossible to get the color out for subsequent redyeing if the housewife should wish to do that. This development reopens to acetate the vast market in the home furnishings field for fine drapery materials, for comfort covers, for bedspreads, and as a component fiber in blends with others in upholstery materials. It is reasonable to suppose, too, that acetate marquisette curtains will get a new lease on life after this development. However, this acetate is no more resistant to the physical degradation by sunlight than the former acetate fibers so they can be expected to sun rot.

It must be kept in mind that it is very difficult to transfer fiber properties or even yarn properties into fabric end-use performance criteria. The fabric construction, its treatment, its dyeing, and its other physical handling characteristics and history will have a more profound effect on the physical properties of the fabric in the consumers home than very small differences in fiber properties especially in the case of blends. Thus it is entirely possible for a manufacturer of a fabric or of a final article to use any one of these wonderful new fibers in such a way as to neutralize or to completely counteract its advantages. For example, there have been some comments that certain Chromspun drapery fabrics split. This would be due to the fact that an inferior fabric was made of Chromspun yarns; similarly, I would regard the over oil-sized fiberglas curtains as an inferior fabric made from this wonderful fiber. The point I am trying to make is that some day we must have a system of end-use requirements for such things as curtains, draperies, rugs, upholstery material, comfort covers, blankets, as well as our utilitarian household fabrics and even our wearing apparel based upon the ability of the fabric to fulfill the required need. A step in this direction has already been taken by some of the institutional buyers and users of textiles. For examples, the American Hotel Association is to be the sponsor for a program to set up end-use performance standards for all the textile products used in institutions such as hotels, hospitals, educational institutions, etc. This program is being undertaken by the American Standards Association and will proceed in somewhat the same manner as the development of the rayon and acetate standards by Committee L-22 of the American Standards Association. I am looking forward with keen anticipation to the program of this sectional committee of the ASA for I think it can set a pattern for similar programs in behalf of the ultimate consumer--the American housewife. In all probability there would be then two minima of performance characteristics: one, for the average American home, whatever that average may be; and the other with somewhat more rigourous performance requirements for the institutional user. All I can do is to urge that everyone--consumers, institutional buyers, distributors, and producers--cooperate in the development of this set of standards. This program is even more important in the case of finding the true place for each of these new synthesized fibers. It will help to guide them into the proper end-use channels for which their individual properties alone or in blends will be capitalized on to the greatest extent. It will avoid their being channeled into poor use categories with the resultant chance of a new fiber being given a permanent black eye in the opinion of consumers and users who may have purchased the inferior or misdirected fabric. For every one of the synthesized fibers on the market today, there are probably five or ten more in the laboratory test stage. Many of them will never see the light of day as a name textile fiber, but some will find their place in the textile industry of the next ten years.

DISCUSSION:

Q. Would there be any damage of sunlight that comes through a glass pane setting fire to orlon?

Ans. No. It requires a flame.

Q. Has the problem of breaking been solved in fiberglas?

Ans. Yes, no complaints the last two years.

Q. How about yarn slippage in fiberglas?

Ans. Depends upon the weave and process used.

Q. Would damage from smudge be comparable to other gases?

Ans. Yes.

Q. Does coronizing render fiberglas much more resistant to deterioration?

Ans. Yes.

Q. Does the weight of fiberglas require special hanging consideration?

Ans. No. Not usually.